AIRPORT CAPACITY ENHANCEMENT

TACTICAL INITIATIVE

LOS ANGELES INTERNATIONAL AIRPORT

COMMUTER GATE PLACEMENT DESIGN TEAM STUDY

Los Angeles International Airport

Airport Capacity Enhancement Tactical Initiative

January 1996

Commuter Gate Placement Design Team Study

Prepared jointly by the U.S. Department of Transportation, Federal Aviation Administration, the City of Los Angeles Department of Airports, and the airlines serving Los Angeles.

Table of Contents

Section 1 — Introduction **5**
Objective 6
Background 6
Scope 7
Methodology 7

Section 2 — Commuter Gate Location Alternatives **9**

Section 3 — Conclusions **19**

Appendix A — Participants **23**

Appendix B — Data Inputs and Assumptions **25**

Appendix C — Computer Model and Methodology **30**
The Airport Machine 30
Methodology 30

Appendix D — List of Abbreviations **31**

Figure 1. Airfield Delay, Present Demand, No Taxiway Tango West Construction 16
Figure 2. Airfield Delay, Future Demand, No Taxiway Tango West Construction 17
Figure 3. Airfield Delay, Future Demand, Taxiway Tango West Completed 17
Figure 4. Summary of Alternatives and Daily Delay Hours by Commuter, non Commuter, and Airfield Delays 20
Figure 5. Aircraft Class — Definition 26
Figure 6. Demand Schedule — By Aircraft Class 26
Figure 7. Commuter Airline Codes For LAX 26
Figure 8. Demand Levels 27
Figure 9. Other Aircraft Assumptions 27
Figure 10. Profile of Daily Demand — Hourly Distribution 27
Figure 11. Runway Use — Present and Future Schedule 28
Figure 12. LAX Airline Gate Assignments 28

Section 1

Introduction

Objective

This study was initiated by the Los Angeles Department of Airports and the Federal Aviation Administration (FAA) to evaluate the impact on overall airfield delays and travel times associated with alternative commuter aircraft gate locations at Los Angeles International Airport (LAX).

The study examined airport delays and their causes with and without relocating/rearranging commuter aircraft gates.

Background

Since 1985, the FAA has sponsored Airport Capacity Design Teams at airports across the country affected by delay. Representatives from airport operators, air carriers, other airport users, and aviation industry groups work together with FAA representatives to identify and analyze capacity problems at each individual airport and recommend improvements that have the potential for reducing delays. The improvements recommended by the Capacity Teams have emphasized construction of new runways and taxiways, installation of enhanced facilities and equipment, and changes in air traffic control procedures. Typically, these solutions are addressed through established, long-term planning processes.

The FAA's Office of System Capacity (ASC) has undertaken a series of initiatives to identify, evaluate, and implement capacity improvements which are achievable in the near term and will provide more immediate relief for chronic delay-problem airports. Airport Capacity Enhancement (ACE) Action Teams will be established at selected airports, again made up of representatives from airport operators, air carriers, other airport users, FAA, and aviation industry groups, to assess these near-term, tactical initiatives and guide them through implementation.

In the preceding several years, Los Angeles International Airport has experienced a large increase in the number of commuter aircraft using the airport. This increase has required the use of more of the existing large aircraft gates for commuter operations. It has also meant far more interaction between the commuter type aircraft and the non-commuter aircraft. In an attempt to solve both of these problems, it has been proposed that the FAA examine the delay effect of several alternative gate locations for the commuters. These alternatives were to be examined both for a present and future traffic demand. A side issue was a requirement to examine the possible delay improvement if Taxiway Tango West (T-West), located on the north side, was constructed.

Subsequently, in May 1994, at the request of the Los Angeles International Airport, an ACE Action team was formed to study the placement of commuter gates.

Scope

The Capacity Team limited its analysis to aircraft activity within the terminal area airspace and on the airfield. They considered the technical and operational feasibility of the proposed improvements, but did not address environmental and design issues or the cost of development and construction. This study examined airfield, non-commuter, and commuter delays both for the present commuter gate locations and various alternative locations. The benefit of adding Taxiway Tango West to the northwest side of the airfield was also examined under each alternative.

Methodology

The ACE Action Team, which included representatives from the FAA, the City of Los Angeles Department of Airports, and various aviation industry groups (see Appendix A), met periodically for review and coordination. The ACE Action Team considered various commuter gate alternatives proposed by the members of the team. Alternatives that were considered practicable were developed into experiments that could be tested through simulation modeling. The FAA Technical Center's Aviation Capacity Branch provided expertise in airport simulation modeling. The ACE Action Team validated the data used as input for the simulation modeling and analysis and reviewed the interpretation of the simulation results. The data, assumptions, alternatives, and experiments were continually reevaluated, and modified where necessary, as the study progressed. Data input and assumptions can be found in Appendix B.

Initial work consisted of gathering data and formulating assumptions required for the capacity and delay analysis and modeling. Where possible, assumptions were based on actual field observations at LAX. Data generated by the 1993 ACE Action Team Study were used whenever possible. Alternative commuter gate locations, proposed by the ACE Action Team, were reviewed and analyzed in relation to current and future demands with the help of a computer model, the Airport Machine. Appendix C briefly explains the model.

Delay costs reflected in this report are based on a $1,923.11 per hour cost as calculated by the 1993 Tom Bradley International Terminal West Side Gates Expansion Study.

Section 2

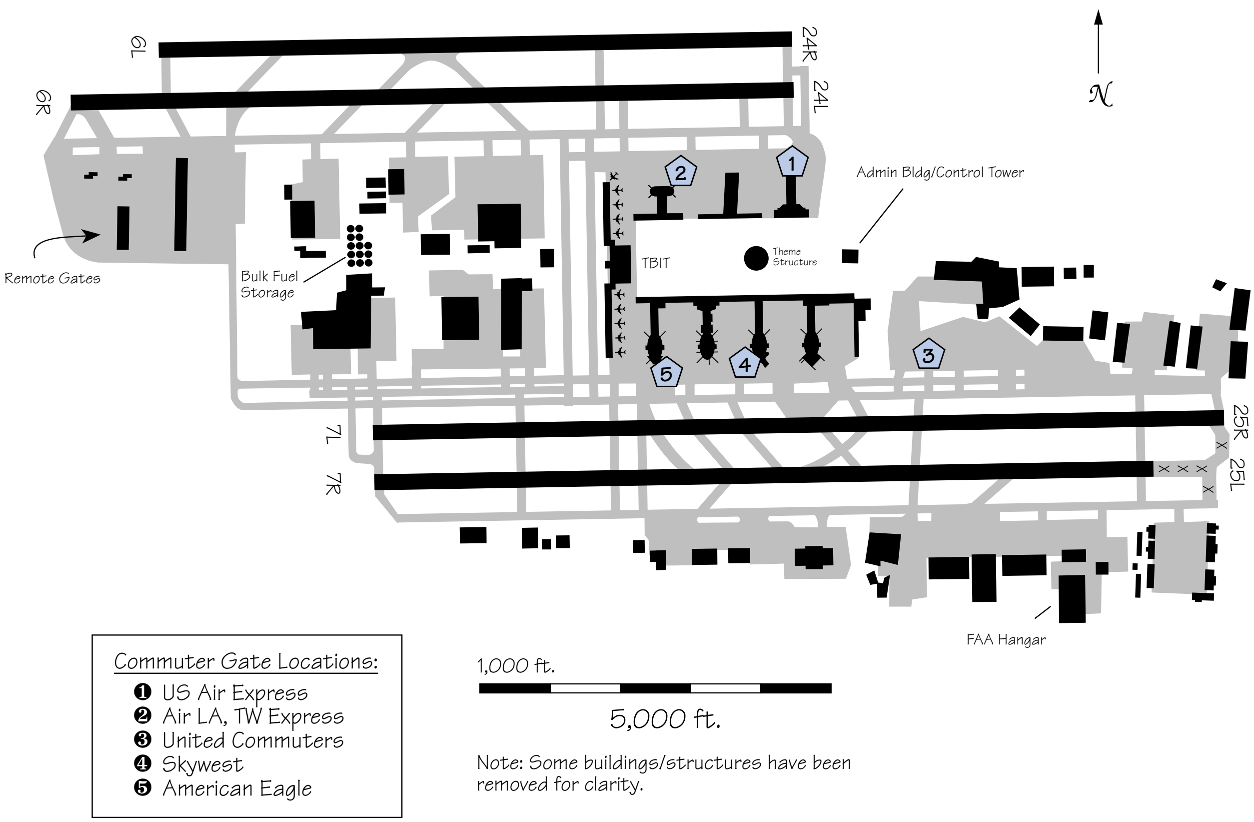
Commuter Gate Location Alternatives

In studying the impact of the proposed relocation of the commuter aircraft gates, the Airport Capacity Enhancement (ACE) Action Team evaluated several alternatives which are detailed in the following pages.

1. Do Nothing Configuration

For the present demand level, the Do Nothing configuration represents today's airfield, operating under the 1994 flight schedule, with no physical changes. For the future demand level, the Do Nothing configuration includes today's airfield with Taxiway K completed from the gate area east of Terminal 8 to the end of Runway 25R. It is assumed that the Sepulvada tunnel expansion to the north was completed allowing Taxiway K to be totally independent of Taxiway J.

Following is a summary of delay times and the cost associated with the Do Nothing, or present airfield, configuration.



Demand	Taxiway Tango West	Gate Configuration	Total (Hours per Day) Runway Delay	Taxiway Delay	Nominal Travel Time	Total Delays	Delay Plus Travel	Cost
Present	No	Do Nothing	34.4	23.7	197.7	58.0	255.7	$491,706
Future	No	Do Nothing	55.7	32.5	223.8	88.2	312.0	$600,077
Future	Yes	Do Nothing	58.1	32.5	224.6	90.6	315.2	$606,126

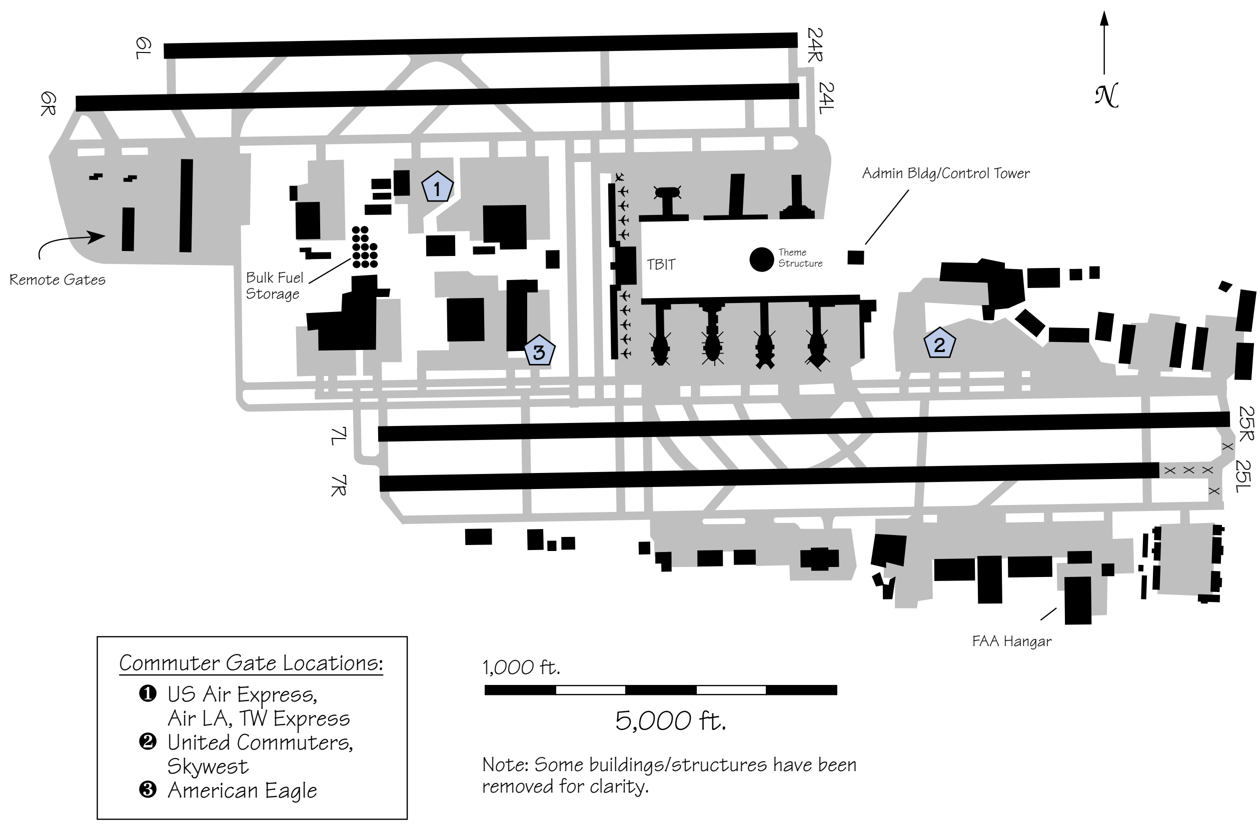
2. Commuter Gate Configuration 1

Commuter airlines Air LA, TW Express, and USAir Express are relocated to a common use terminal east of Taxiway 61 and south of Taxiway U. They would arrive and depart a common use area via Taxiway 61. These airlines would vacate gates 12B, 13, 14, and 36.

Skywest would relocate to the Delta maintenance area. Skywest would arrive and depart leasehold via Taxiway 27K. This would vacate gates 65, 67A, and 67B.

American Eagle would relocate to the American maintenance area. American Eagle would arrive and depart leasehold via Taxiway 52K. This would vacate gates 48 and 49B.

Following is a summary of delay times and the cost associated with the gate configuration 1.

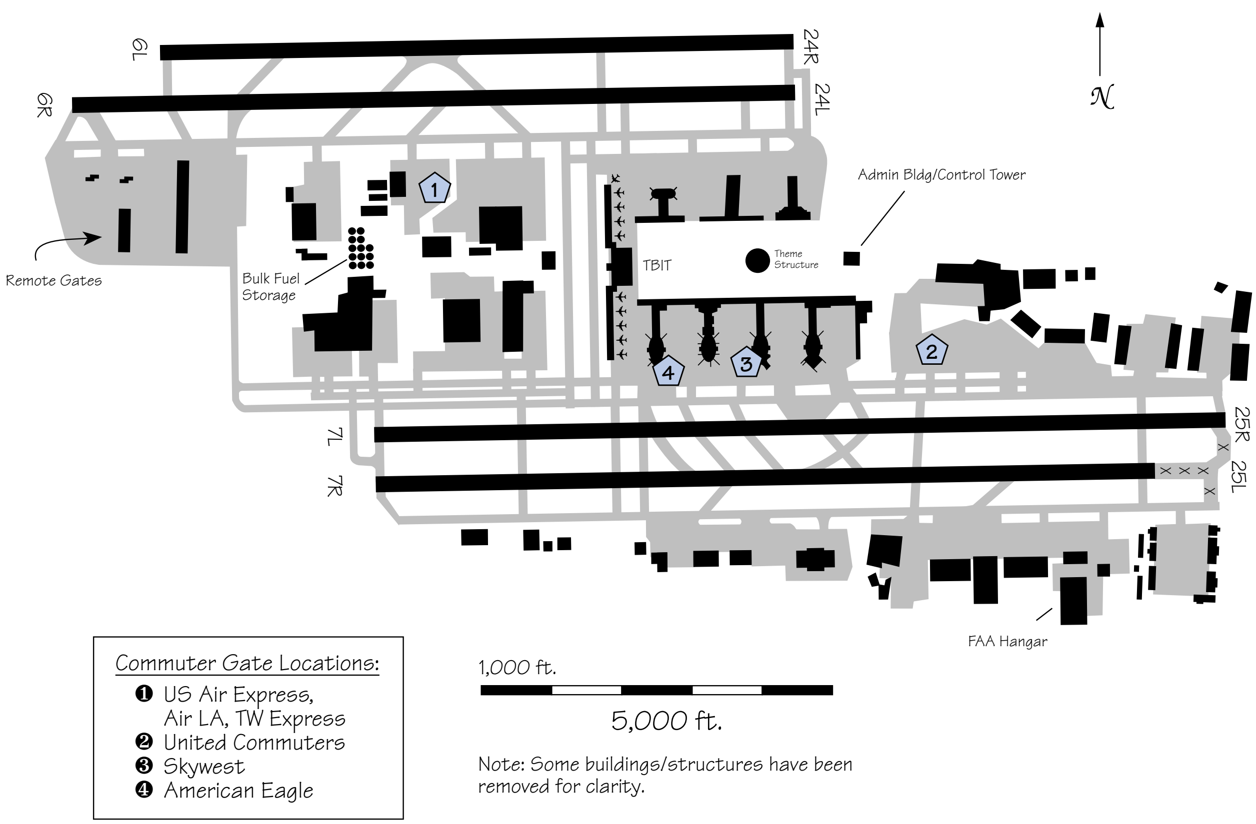


Demand	Taxiway Tango West	Gate Configuration	Total (Hours per Day)			Total Delays	Delay Plus Travel	Cost
			Runway Delay	Taxiway Delay	Nominal Travel Time			
Present	No	1	30.3	17.4	196.9	47.7	244.6	$470,353
Future	No	1	56.8	32.7	222.8	89.4	312.2	$600,460
Future	Yes	1	58.9	31.9	223.0	90.8	313.7	$603,327

3. Commuter Gate Configuration 1A

Commuter airlines Air LA, TW Express, and USAir Express are relocated to a common use terminal East of Taxiway 61 and south of Taxiway U. They would arrive and depart a common use area via Taxiway 61. These airlines would vacate gates 12B, 13, 14, and 36.

Following is a summary of delay times and the cost associated with the gate configuration 1A.



Demand	Taxiway Tango West	Gate Configuration	Total (Hours per Day) Runway Delay	Taxiway Delay	Nominal Travel Time	Total Delays	Delay Plus Travel	Cost
Present	No	1A	37.6	22.0	196.9	59.6	256.5	$493,331
Future	No	1A	56.2	34.6	224.0	90.8	314.8	$605,437
Future	Yes	1A	57.8	30.0	224.1	87.7	311.8	$599,695

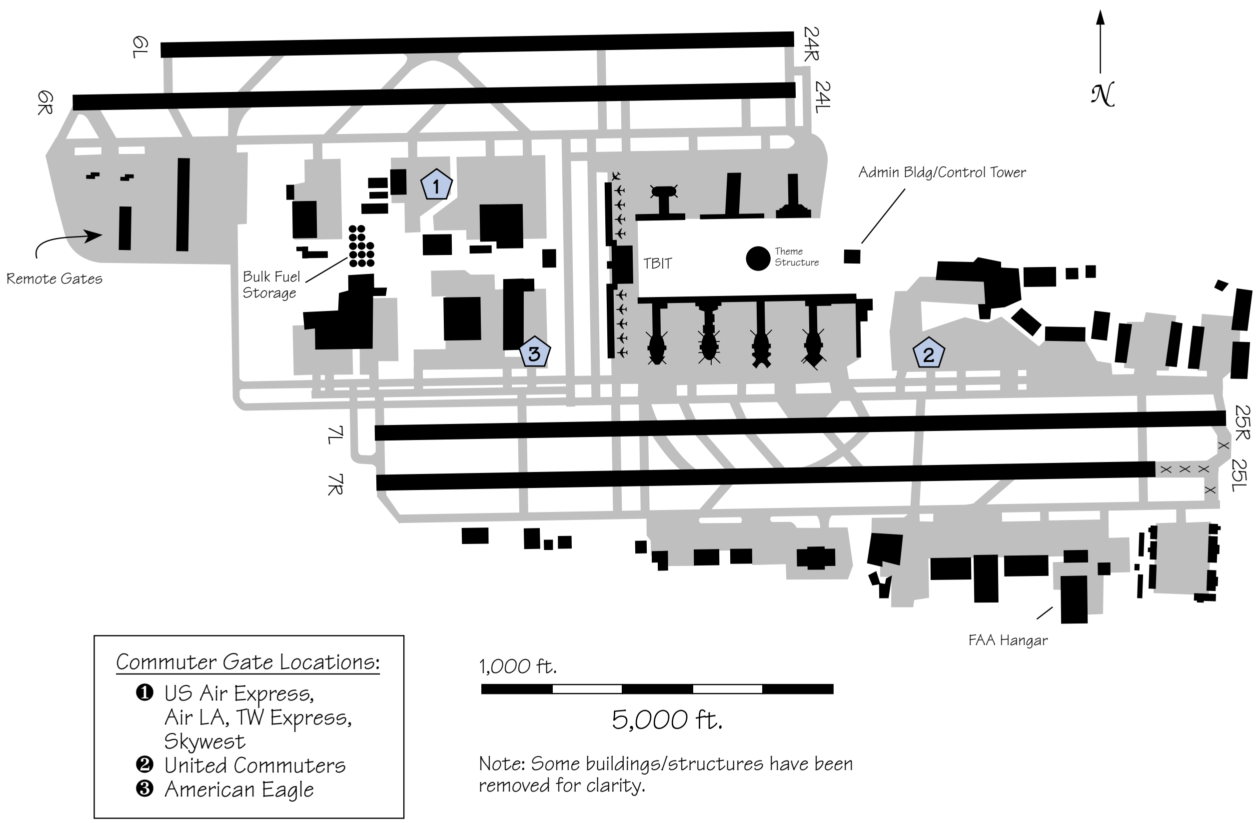
4. Commuter Gate Configuration 2

Commuter airlines Air LA, TW Express, and USAir Express are relocated to a common use terminal east of Taxiway 61 and south of Taxiway U. They would arrive and depart a common use area via Taxiway 61. These airlines would vacate gates 12B, 13, 14, and 36.

Skywest would relocate to a new common use terminal east of Taxiway 61 and south of Taxiway U. Skywest would arrive and depart the common use area via Taxiway 61. This would vacate gates 65, 67A, and 67B.

American Eagle would relocate to the American maintenance area. American Eagle would arrive and depart leasehold via Taxiway 52K. This would vacate gates 48 and 49B.

Following is a summary of delay times and the cost associated with gate configuration 2.



Demand	Taxiway Tango West	Gate Configuration	Total (Hours per Day) Runway Delay	Total (Hours per Day) Taxiway Delay	Total (Hours per Day) Nominal Travel Time	Total Delays	Delay Plus Travel	Cost
Present	No	2	32.3	18.8	198.7	51.1	249.8	$480,371
Future	No	2	60.7	31.0	226.1	91.7	317.8	$611,158
Future	Yes	2	53.4	25.3	226.9	78.7	305.6	$587,784

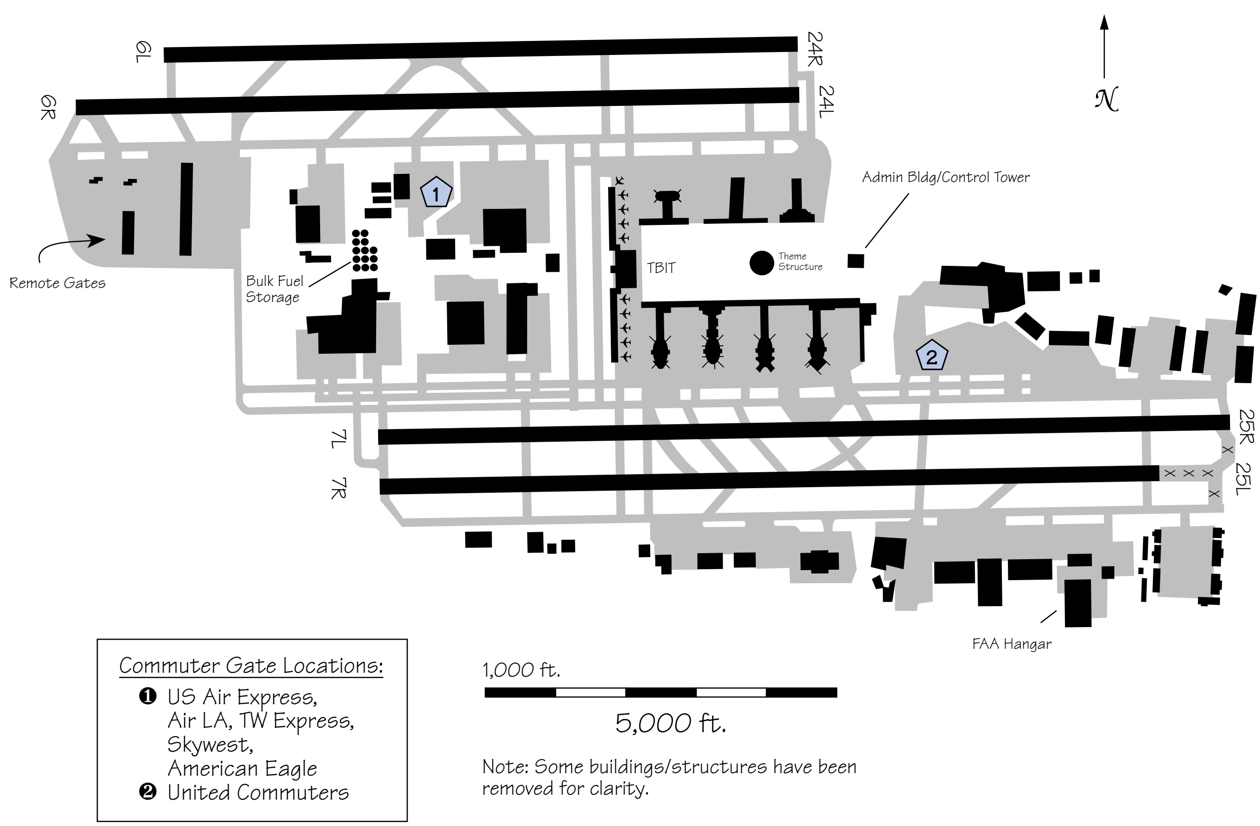
5. Commuter Gate Configuration 3

Commuter airlines Air LA, TW Express, and USAir Express are relocated to a common use terminal east of Taxiway 61 and south of Taxiway U. They would arrive and depart a common use area via Taxiway 61. These airlines would vacate gates 12B, 13, 14, and 36.

Skywest would relocate to a new common use terminal east of Taxiway 61 and south of Taxiway U. Skywest would arrive and depart the common use area via Taxiway 61. This would vacate gates 65, 67A, and 67B.

American Eagle would relocate to a new common use terminal east of Taxiway 61 and south of Taxiway U. American Eagle would arrive and depart the common use area via Taxiway 61. This would vacate gates 48 and 49B.

Following is a summary of delay times and the cost associated with gate configuration 3.

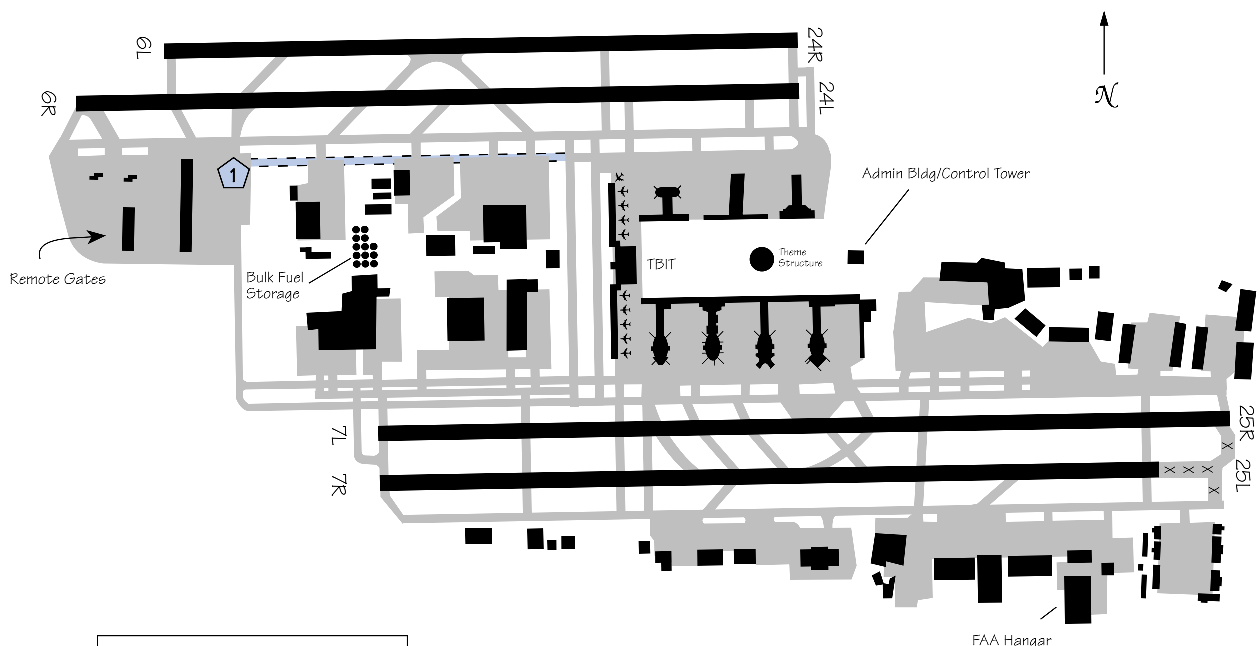


Demand	Taxiway Tango West	Gate Configuration	Total (Hours per Day): Runway Delay	Total (Hours per Day): Taxiway Delay	Total (Hours per Day): Nominal Travel Time	Total Delays	Delay Plus Travel	Cost
Present	No	3	33.4	23.6	200.5	57.0	257.5	$495,208
Future	No	3	55.8	35.1	229.8	90.9	320.7	$616,749
Future	Yes	3	55.5	25.3	230.1	80.8	310.9	$597,892

6. Taxiway Tango West Completed West of Taxiway 49

This alternative was examined in conjunction with all the above alternatives but only with the future traffic demand. In all of the cases, it was assumed that Taxiway K, east of Terminal 8, was completed; the Sepulvada Tunnel was expanded to the north; and Taxiway T was extended west from Taxiway 49 to Taxiway 75.

Following is a summary of delay times and the associated cost when Taxiway T is completed with alternative 1, 1A, 2, and 3 configurations.



Construction Option:
❶ Taxiway T Completed

1,000 ft.

5,000 ft.

Note: Some buildings/structures have been removed for clarity.

			Total (Hours per Day)					
Demand	Taxiway Tango West	Gate Configuration	Runway Delay	Taxiway Delay	Nominal Travel Time	Total Delays	Delay Plus Travel	Cost
Future	Yes	1	58.9	31.9	223.0	90.8	313.7	$603,327
Future	Yes	1A	57.8	30.0	224.1	87.7	311.8	$599,695
Future	Yes	2	53.4	25.3	226.9	78.7	305.6	$587,784
Future	Yes	3	55.5	25.3	230.1	80.8	310.9	$597,892

Figures 1, 2, and 3 provide a summary of the daily delays and travel times for the various alternatives. Note that the alternatives with the least delay hours per day are shaded. The sum of the component delays may not equal the total exactly because of machine rounding. Headings used in these presentations are defined below:

Rwy Delay:
The total runway delay per day for arrivals, departures, or arrivals and departures as indicated. For arrivals, delay is calculated as the actual time an aircraft crossed the runway threshold minus the undelayed time. For departures, delay is calculated as the time the aircraft commenced departure roll minus the time it would have been available to take off if not delayed.

Twy Delay:
The total taxiway delay per day for arrivals, departures, or arrivals and departures as indicated. Taxiway delay is the delay accumulated when an aircraft is required to stop at an intersection due to a conflict.

Gate Delay:
The total gate delay per day for arrivals. Gate delay is the time an aircraft spends at a parking node waiting for a gate.

Rwy Cross Delay:
The total runway crossing delay per day for arrivals or departures as indicated. Runway crossing delay is the delay accumulated when an aircraft is required to stop at a runway due to a conflict.

Nominal Travel Time:
The total unobstructed travel time per day that aircraft incur for arrivals, departures, or arrivals and departures as indicated.

Total Delay:
The total runway, runway crossing, taxi, and gate delay per day for arrivals and departures.

Delay + Travel:
The total delay and unobstructed travel time per day for arrivals and departures.

Figure 1. Airfield Delay (Hours per Day), Present Demand, No Taxiway Tango West Construction.

		Gate Configuration				
		Do Nothing	1	1A	2	3
Arrivals	Rwy Delay	5.3	5.5	5.5	5.4	5.4
	Twy Delay	12.8	8.7	11.1	9.8	13.5
	Gate Delay	0.6	0.3	0.6	0.3	0.3
	Rwy Cross Delay	20.0	19.8	19.8	18.5	20.3
	Nominal Travel Time	75.9	74.8	74.4	43.6	74.3
Departures	Rwy Delay	29.1	24.8	32.2	26.9	28.0
	Twy Delay	10.9	8.7	10.9	9.0	10.1
	Rwy Cross Delay	8.9	7.5	11.9	8.2	10.1
	Nominal Travel Time	121.8	122.0	122.5	125.1	126.2
Total	Rwy Delay	34.4	30.3	37.6	32.3	33.4
	Twy Delay	23.7	17.4	22.0	18.8	23.6
	Nominal Travel Time	197.7	196.9	196.9	198.7	200.5
	Total Delays	58.0	47.7	59.6	51.1	57.0
	Delay + Travel	255.7	244.6	256.5	249.8	257.5

Figure 2. Airfield Delay (Hours per Day), Future Demand, No Taxiway Tango West Construction.

		Gate Configuration				
		Do Nothing	1	1A	2	3
Arrivals	Rwy Delay	21.4	21.5	21.5	21.2	21.4
	Twy Delay	14.6	14.7	14.3	15.0	17.1
	Gate Delay	2.8	1.2	1.5	1.3	1.2
	Rwy Cross Delay	24.5	26.2	25.9	26.9	25.9
	Nominal Travel Time	85.1	84.2	84.4	83.8	85.3
Departures	Rwy Delay	34.3	35.3	34.7	39.5	34.4
	Twy Delay	17.9	18.0	20.3	16.0	18.0
	Rwy Cross Delay	3.0	2.3	2.1	2.8	2.6
	Nominal Travel Time	138.8	138.6	139.6	142.3	144.5
Total	Rwy Delay	55.7	56.8	56.2	60.7	55.8
	Twy Delay	32.5	32.7	34.6	31.0	35.1
	Nominal Travel Time	223.8	222.8	224.0	226.1	229.8
	Total Delays	88.2	89.4	90.8	91.7	90.9
	Delay + Travel	312.0	312.2	314.8	317.8	320.7

Figure 3. Airfield Delay (Hours per Day), Future Demand, Taxiway Tango West Completed.

		Gate Configuration				
		Do Nothing	1	1A	2	3
Arrivals	Rwy Delay	21.4	21.6	21.5	21.2	21.4
	Twy Delay	14.4	13.2	12.2	11.7	10.8
	Gate Delay	2.7	1.2	2.0	1.3	0.9
	Rwy Cross Delay	24.5	26.3	26.1	25.9	25.7
	Nominal Travel Time	85.5	84.4	84.6	84.2	85.6
Departures	Rwy Delay	36.7	37.3	36.3	32.2	34.1
	Twy Delay	18.1	18.7	17.8	13.7	14.4
	Rwy Cross Delay	2.2	2.6	2.4	2.3	3.0
	Nominal Travel Time	139.0	138.6	139.5	142.7	144.5
Total	Rwy Delay	58.1	58.9	57.8	53.4	55.5
	Twy Delay	32.5	31.9	30.0	25.3	25.3
	Nominal Travel Time	224.6	223.0	224.1	226.9	230.1
	Total Delays	90.6	90.8	87.7	78.7	80.8
	Delay + Travel	315.2	313.7	311.8	305.6	310.9

Section 3

Conclusions

Figure 4 summarizes the delay hours per day for each alternative relative to the Do Nothing alternative for the commuter fleet, non commuter fleet and for the airfield which is the total LAX fleet. Three conditions, Present Demand, Future Demand, and Future Demand with Taxiway Tango West are displayed.

Figure 4. Summary of Alternatives and Daily Delay Hours by Commuter, non Commuter, and Airfield Delays (Hours per Day).

Alternative	Demand	Taxiway Tango West	Gate Configuration	Commuter Delays	Non Commuter Delays	Airfield Delays
1	Present	No	Do Nothing	67.3	188.3	255.7
2	Present	No	1	62.0	182.5	244.6
3	Present	No	1A	67.2	189.3	256.5
4	Present	No	2	65.3	184.5	249.8
5	Present	No	3	70.8	186.7	257.5
1	Future	No	Do Nothing	89.0	223.0	312.0
2	Future	No	1	88.7	223.6	312.2
3	Future	No	1A	92.6	222.2	314.8
4	Future	No	2	91.6	226.2	317.8
5	Future	No	3	95.6	225.1	320.7
1 & 6	Future	Yes	Do Nothing	90.8	224.4	315.2
2 & 6	Future	Yes	1	88.9	224.9	313.7
3 & 6	Future	Yes	1A	90.5	221.3	311.8
4 & 6	Future	Yes	2	86.5	219.1	305.6
5 & 6	Future	Yes	3	90.4	220.4	310.9

Within the range of modeling error, no significant increase in overall airfield delay will occur from any of the commuter location scenarios considered. However, there was enough difference between the alternatives to select between them.

For the present demand, the best commuter gate option is gate configuration 1. Arrival and departure total travel times are improved because of segregation of traffic by aircraft type.

For the future demand, the best option is also gate configuration 1. Note that the airfield delays for the future demand will increase overall; however, gate configuration 1 will provide the smallest increase in total travel time.

For the future demand with Taxiway Tango West, the best commuter gate option is gate configuration 2 which will provide the smallest increase in runway delay. In some cases, delay increased with the addition of Taxiway Tango West. The existence of Taxiway Tango West allowed aircraft to reach the departure queue for the north runway complex faster, increased the length of the queue and therefore increased delay.

For both present and future demand, the existing single line departure feed with "first in, first out" (FIFO) logic cannot be used. If the lead departure aircraft is scheduled to use the outside runway (25L), which is busy with arrivals, all departures are held even if the succeeding departures want to use 25R. With the increased demand for the future schedule and the existing FIFO logic, both north and south complex departure queues extend into the gate areas causing grid lock. In order to simulate the airfield using future demands, the use of departure pads for departure staging was assumed. It should be noted that the use of departure pads for future demands was a major recommendation from the LAX Task Force Study. Additionally, upon running the simulation model, the Future Demand will require departure pads on the south complex runways.

Appendix A

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Appendix B

Data Inputs and Assumptions

Figure 5 depicts aircraft class definitions used for this study. The definition of two additional classes of aircraft (Class 1, International Wide Body and Class 3, International Non-Wide Body) is the result of longer pushback times required for international flights.

Figure 6 details the demand schedule used for this study. The future demand schedule totals were supplied by the Los Angeles Department of Airports. The proportional distribution by aircraft class is the same as that observed on October 6, 1994.

Figure 7 displays selected commuter airlines serving Los Angeles International Airport by their 3-letter identification code.

Figure 8 illustrates the daily total and peak-hour demand levels for the present and future case.

Figure 9 depicts additional assumptions concerning aircraft operation which were utilized during computer modeling.

Figure 10 shows the hourly profile of daily demand for the present level of activity and includes a curve that depicts the profile of daily operations for the future demand level. The present demand schedule depicts actual field data collected on October 6, 1994.

Figure 11 displays the present and future demand for individual runways by number of daily operations.

Figure 12 depicts the airline gate assignments at LAX and the gate numbers (APM Gate) used in the Airport Machine simulation model.

Figure 5. Aircraft Class — Definition

Aircraft Class	Definition
1	International Wide Body
2	Domestic Wide Body
3	Internatinoal Non-Wide Body
4	Domestic Non-Wide Body
5	Commuters
6	Normal Twin Engine Propeller

Figure 6. Demand Schedule — By Aircraft Class

Class	Oct 6, '94	New Forecast	% Change '94 to 2000	Mix Oct 6, 94	New Mix Forecast
1	44.5	62.0	39.3%	4.2%	5.2%
2	130.0	132.0	1.5%	12.1%	11.0%
3	28.0	39.0	39.3%	2.6%	3.3%
4	459.0	490.0	6.8%	42.9%	40.8%
5	331.0	398.0	20.2%	30.9%	33.2%
6	78.0	79.0	1.3%	7.3%	6.6%
Total	1,070.5	1,200.0	12.1%	100.0%	100.0%

Figure 7. Commuter Airline Codes For LAX

Commuter Airline	3-Letter Code
Air LA	UED
Alpha Air	ALH
American Eagle	EGF
Mesa Air	ASH
Sky West	SKW
TW Express	LOF
United Express	SDU

Figure 8. Demand Levels

	Aircraft Opaerations	
	24-Hour Day	Peak Hour
Present	2,140	149
Future	2,394	168

Figure 9. Other Aircraft Assumptions

Class	Approach Path	Approach Speed	Landing Speed	Rwy Occ Time	Pushback Time	Gate Service Times (Hrs) Through Flight	Turn Around	Arrive Only	Depart Only
1	6 nm	140 kts	130 kts	60 sec	540 sec	1.7	1.2	0.5	0.5
2	6 nm	140 kts	130 kts	60 sec	180 sec	1.0	1.2	0.5	0.5
3	6 nm	130 kts	120 kts	52 sec	420 sec	0.8	1.0	0.4	0.4
4	6 nm	130 kts	120 kts	52 sec	180 sec	0.8	1.0	0.4	0.4
5	6 nm	130 kts	120 kts	52 sec	60 sec	0.6	0.8	0.3	0.3
6	3 nm	120 kts	110 kts	52 sec	60 sec	0.6	0.8	0.3	0.3

Figure 10. Profile of Daily Demand — Hourly Distribution

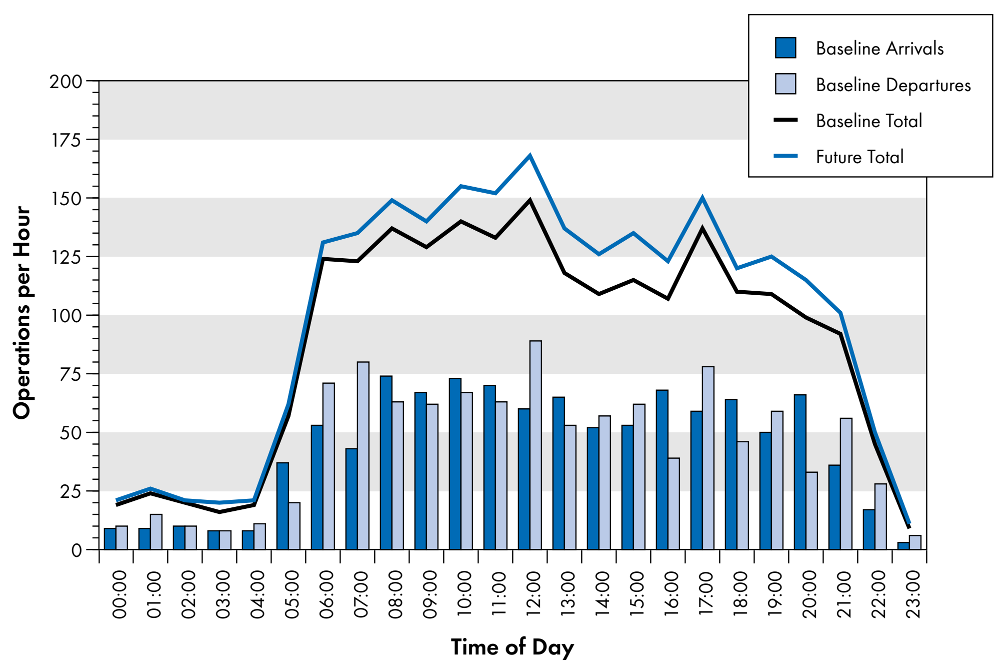

Figure 11. Runway Use — Present and Future Schedule

	Present		Future	
Runway	Arrivals/Day	Departures/Day	Arrivals/Day	Departures/Day
24R	424	51	489	60
24L	77	440	77	485
25R	88	479	76	590
25L	465	116	546	71
Total	1,054	1,086	1,188	1,206

Figure 12. LAX Airline Gate Assignments

LAX GATE	AIRLINE	APM GATE
1	SWA, USA	1
3A	AWE, SWA, USA	2
3B	SWA, USA	3
5	SWA, USA	4
7	SWA, USA	5
9	AWE, SWA, USA	6
11	AWE, SWA, USA	7
13	AWE, LOF, USA	8
13	LOF, SWA	9
13	ALH, LOF, SWA	10
14 ‘	LOF	11
14	LOF	12
14	LOF	13
14A	LOF	14
14A	LOF	15
14A	LOF	16
14A	LOF	17
12B	AWE, SWA, USA	18
10	AWE, SWA, USA	19
8	AWE, SWA, USA	20
6	SWA, USA	21
4B	AWE, SWA, USA	22
4A	SWA, USA	23
2	SWA, USA	24
21A	ACA, NWA	30
21B	ACA, MRK	31
23	MSS, NWA	32
25	NWA	33
27	ACA, NWA	34
28	HAL, NWA	35
26	HAL, KLM, NWA	36
24	ACA, NWA	37
24A	ACA, MRK	38
22	NWA	39
36	UED	40
36	UED	41
39	NWA	45
38	NWA	46
37B	NWA	47
37A	ASA, NWA, TWA	48
36	ALH	49
35	ASA, TWA	50
34	TWA	51
33	ASA, TWA	52
32	MEP, TWA	53
31C	ASA	53
31B	ASA	55
31A	ASA	56
30	ASA	67
41	AAL	60
43A	AAL	61
43B	AAL	62
45	AAL	63
47	AAL	64
49A	AAL	65
49B	EGF	66
49B	EGF	67
49B	EGF	68
49B	EGF	69
49B	EGF	70
49B	EGF	71
48	EGF	72
48	EGF	73
48	EGF	74
48	EGF	75
48	EGF	76
48	EGF	77
46	AAL	78
44	AAL	79
42B	AAL, ROA	80
42A	ROA	81
51A	DAL	85
51 B	DAL	86
53A	DAL	87
53B	DAL	88
55A	DAL	89
55B	DAL	90
57A	DAL	91
57B	DAL	92
59	DAL	93
58	DAL	94
56	DAL	95
54B	DAL	96
54A	DAL	97
52B	DAL	98
52A	DAL	99

Figure 12. LAX Airline Gate Assignments (continued)

LAX GATE	AIRLINE	APM GATE
50B	DAL	100
61	DAL	105
63	DAL	106
65	SKW	107
65	SKW	108
65	SKW	109
65	SKW	110
67A	SKW	111
67A	SKW	112
67A	SKW	113
67A	SKW	114
67A	SKW	115
67B	SKW	116
67B	SKW	117
67B	SKW	118
67B	SKW	119
67B	SKW	120
69A	DAL	121
69B	COA, DAL	122
68B	COA	123
68A	COA	124
66	COA	125
64	COA	126
62	COA	127
60	COA	128
71A	UAL	130
71B	UAL	131
73A	UAL	132
73B	UAL	133
75	UAL	134
77	UAL	135
76	UAL	136
74	UAL	137
72B	UAL	138
72A	UAL	139
70B	UAL	140
70A	UAL	141
80	UAL	145
81	UAL	146
82	UAL	147
83	UAL	148
84	UAL	149
101	AMX, CAA, LWD, UAL	155
102	KAL, MAS, QFA, UAL	156
103	AMT, DLH, SIA, XAL	157
104	AFL, EVA, JAL, DAL, MPH, UAL	158
105	CAL, JAL	159
106	AZA, CAL, CDN, UAL	160
119	AFR, AMX, ASA, LRC, LTU, LWD, MXA	161
UNITED APRON	ASH,SDU	170
UNITED APRON	ASH,SDU	171
UNITED APRON	ASH,SDU	172
UNITED APRON	ASH,SDU	173
UNITED APRON	ASH,SDU	174
UNITED APRON	ASH,SDU	175
UNITED APRON	ASH,SDU	176
UNITED APRON	ASH,SDU	177
UNITED APRON	ASH,SDU	178
UNITED APRON	ASH,SDU	179
UNITED APRON	ASH,SDU	180
UNITED APRON	SDU	181
108	AMT, ANZ, MXA	185
206	SIA, VSP	186
204	JAL, MXA	187
202	AMT, LWD	188
209	AAR	189
207	ANA, MXA	190
205	BAW, ELY, MXA	191
203	AMX,QFA, SER, VRG	192
201	SER,VIR	193
218	KAL, LWD	194
216	AMT, LAN, QFA	195
214	ANZ, LAN	196
212		197
210	MXA, PAC	198
219	CAA, SWR	199
217	AMX, CPA, KAL, MXA	200
215	KAL, LWD, SET	201
213	CDN, MXA	202
211	ANZ	203
IMPERIAL	MGM, ROA	210
IMPERIAL		211
IMPERIAL		212
IMPERIAL	HAL, MGM, RLT	213
IMPERIAL	MSS	214
SOUTH SIDE REMOTES	EWW	216
SOUTH SIDE REMOTES	CGD, EJA, GA, MDC, MRA, SMO	217
SOUTH SIDE REMOTES	CKS, CWC, DHL, EIA, FDX	218
SOUTH SIDE REMOTES	FLC, LHN, MPX, PCM, RYN	218
SOUTH SIDE REMOTES	ABX, AMF, MPA	219
120	AMX, BAW, PAL, SER, SIA, UAL	162
121	EVA, MXA, SIA, UAL	163
122	AAR, ASA, JAL, MXA, TOW, TWA	164
123B	AMX, CDN, MXA, SER, XAR	165
123A	ASA, LRC	166
SOUTH SIDE REMOTES FREIGHT	ZAN	220
TWA HANGER	UPS	226
AAL HANGAR		227

Appendix C

Computer Model and Methodology

The Los Angeles International Airport ACE Action Team studied the effects of commuter aircraft gate locations on airfield delays and travel times. The analysis was performed using computer modeling techniques. A brief description of the model and the methodology employed follows.

The Airport Machine

The Airport Machine is a PC-based, interactive model with animated graphics display that is used to evaluate proposed changes to airfield and terminal configurations, schedules, and aircraft movement patterns. It is an excellent tool for taxiway and gate analysis. Output from the model provides extensive data on delays and travel times in aircraft movements.

Methodology

Model simulations included present and future air traffic control procedures, various improvements, and traffic demands for different times. A west flow runway configuration was used to assess the benefits of proposed commuter gate locations, which was derived from present and projected airport layouts. The projected implementation time for air traffic control procedures and system improvements determined the aircraft separations used for VFR weather simulations.

For the delay analysis, agency specialists developed traffic demands based on the Automated Radar Terminal System (ARTS), historical data, field observations, and various forecasts. Aircraft volume, mix and peaking characteristics were developed for each demand level (present and future). The estimated daily delays for the proposed gate options were calculated from the experimental results. These estimates considered runway configuration, weather, and demand based on historical data.

Appendix D

List of Abbreviations

ACE	Airport Capacity Enhancement
APM	Airport Machine — computer simulation model
ARTS	Automated Radar Terminal System
ASC	FAA Office of System Capacity
ATC	Air Traffic Control
ATCT	Airport Traffic Control Tower
FAA	Federal Aviation Administration
IFR	Instrument Flight Rules
KTS	Nautical Miles per Hour
LAX	Los Angeles International Airport
NM	Nautical Miles
TBIT	Tom Bradley International Terminal
VFR	Visual Flight Rules
WESTPAC	Western Pacific — Remote Terminal Gates

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